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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/663,593	09/18/2000	Raymond Van Roijen	PHN 17,638	4051

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EXAMINER	
DICKEY, THOMAS L	

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 03/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/663,593	VAN ROIJEN ET AL.	
	Examiner	Art Unit	
	Thomas L Dickey	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 March 2004* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *6,8 and 10-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *6,8 and 10-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☒ The proposed drawing correction filed on *15 April 2002* is: a)☒ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 01/14/2004 has been entered.

Drawings

2. New corrected drawings are required in this application because applicant has not yet submitted a formal replacement drawing sheet effecting the changes applicant proposed in his drawing correction filed 04/15/2002. These drawing corrections were approved in the Action mailed 05/22/2002. Applicant is advised to employ the services of a competent patent draftsperson outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 11,12,14, and 15 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. When a combination is claimed in a amended claim, the entire combination must have been disclosed, as a combination, in the application as filed. Applicant's original application does not disclose the entire combination of claims 11 and 15, including all the limitations recited in claims 6 and 8, in combination with a second conductivity type deep via disposed adjacent to, and in electrical contact with, the second region of claim 6 or 8.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

A. Claims 6, 10, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over ISOHATA et al. (JP 10321842 A) in view of SUZUMURA et al. (6,211,551).

Isohata et al. discloses a semiconductor device comprising a semiconductor body having a first region (source) 8a of a first conductivity (n) type and, adjoining thereto, a second region (body, or back gate) 1 of the second, opposite (p), conductivity type, a third (drift) region 8b of the first conductivity (n) type, which is adjacent the second region (body, or back gate) 1 and separated from the first region (source) 8a only by the second region (body, or back gate) 1, and a fourth (drain) region 12b2 of the first conductivity (n) type which is separated from the second region (body, or back gate) 1 by the third (drift) region 8b, the fourth (drain) region 12b2 has a higher doping concentration (n+) than the third (drift) region 8b (which is n-), the first 8a, the second 1, and the fourth 12b2 regions being provided with a terminal (said terminal may be either electrode 18a or electrode 18b), wherein the third (drift) region 8b is provided with a

protection zone 12b1 of the first conductivity (n) type having a higher doping concentration (n+) than the third (drift) region 8b (which is n-), which protection zone 12b1 is separated from the second region (body, or back gate) 1 by the third (drift) region 8b and is situated near the fourth (drain) region 12b2 and around the fourth (drain) region, and separated from said fourth (drain) region 12b2 by an intermediate, comparatively high-impedance region, wherein the third (drift) region 8b and the fourth (drain) region 12b2 form, respectively, a drift region and a drain region of a lateral DMOS transistor. Note figures 2A and 2B of Isohata et al.

Isohata et al. does not disclose that the first type protection zone (which is formed in the first type drift region between the second type body/back-gate and the first type drain) forms a ring around the drain, or that the first (source) region and second (body/back-gate) region are electrically coupled, or that the third (drift) region is disposed over an insulating substrate (SOI).

However, Suzumura et al. discloses a semiconductor device where everything (drift region, not numbered but marked "N" in figures 3 and 4, body/back-gate 13, and source 12) is formed in a ring around drain 14, where "second region" body/back-gate 13 and "first region" source 12 are electrically coupled by source electrode 42 in order to pin the back-gate potential to the source potential to lower the threshold voltage and prevent "parasitic bipolar" transistor effects, and where the third (drift) region (not numbered but

marked "N" in figures 3 and 4) is disposed over an insulating substrate (SOI). Note Figs. 3,4, and column 2 lines 20-53 of Suzumura et al. Suzumura et al. explains the distinct advantages of the ring type geometry employed over the insulating substrate. Because (says Suzumura et al.) forming the drift region over a buried oxide layer exhibits much lower capacitance than forming the drift region over a silicon layer (as it is in Isohata et al., it is possible to greatly reduce a drain-source capacitance for minimizing the output capacitance of the device in the non-conductive condition. Also the insulating substrate can reduce the total P-N interface area of the drift region and thus reduce a leak current at the non-conducting condition of the output terminals. Moreover, the ring structure allows the source region to confront the drain region over a prolonged line in the plane of the silicon layer, thereby reducing an on-state resistance between the output terminals of the device. According to Suzumura et al. the result is that the device can enjoy an optimum combination of the low output capacitance and the low on-state resistance.

Therefore, it would have been obvious to a person having skill in the art to form the first type protection zone of Isohata et al.'s semiconductor device in a ring, inside a ring-shaped "third" drift region and between a ring shaped "second region" body/back-gate and a drain, over an insulating substrate, and electrically couple the first (source) region and second (body/back-gate) region such as taught by Suzumura et al. in order to allow

the source region to confront the drain region over a prolonged line in the plane of the silicon layer, greatly reduce a drain-source capacitance, and prevent parasitic bipolar transistor turn-on, to thus provide better an optimum combination of low output capacitance and low on-state resistance.

B. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over ISOHATA et al. (JP 10321842 A) in view of SUZUMURA et al. (6,211,551) and further in view of Wondrak et al. (5,578,859).

Isohata et al. and Suzumura et al. disclose all the limitations of claim 8 except that the device is of the RESURF type, wherein the product of the thickness and the doping concentration of the third region is approximately 10^{12} atoms per cm^2.

However, Wondrak et al. discloses a semiconductor device with a third region of the first conductivity type, which is adjacent the second region and separated from the first region by the second region, that forms a drift region of a Lateral DMOS transistor, where the device is of the RESURF type, and therefore the product of the thickness and the doping concentration of the third region meets the well known RESURF criterion of being approximately 10^{12} atoms per cm^2. Note column 2 lines 30-37 of Wondrak et al. Therefore, it would have been obvious to a person having skill in the art to replace the third region of the first conductivity type of Isohata et al.'s semiconductor device with the third region of the first conductivity type, which is adjacent the second region and

separated from the first region by the second region, that forms a drift region of a Lateral DMOS transistor, where the device is of the RESURF type, and therefore the product of the thickness and the doping concentration of the third region meets the well known RESURF criterion of being approximately 10^{12} atoms per cm^2, such as taught by Wondrak et al. in order to reduce the surface field of the lateral DMOS to thus provide a better breakdown voltage.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas L Dickey whose telephone number is 571-272-1913. The examiner can normally be reached on Monday-Thursday 8-6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 703-308-6601. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you

have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TLD
03/2004

Minhloan Tran
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